CYLINDROTAENIA AMERICANA NOV. SPEC. FROM THE CRICKET FROG*

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In the fall of 1914, while looking for parasites, I found a cestode in the intestine of a cricket frog, *Acris gryllis*. Further collections were made and the repeated occurrence of the tapeworm showed that it was not merely incidental but a regular parasite in the host mentioned. This discovery was particularly interesting because of the rarity of cestodes, either species or individuals, in amphibians. So far as I have been able to ascertain, only five cestodes have yet been described from amphibians, and of these only two, *Taenia dispar* Goeze (1782), and *Taenia pulchella* Leidy (1851), are from Anura. No cestodes have ever been reported from a member of the genus Acris. For these reasons it was considered worth while to make a morphological and systematic study of this new form, the results of which are presented in the following paper.

I wish to express my thanks to Prof. Henry B. Ward for the use of his library and of materials from his private collections and for many helpful suggestions.

Aside from some fifty specimens I obtained from cricket frogs collected from a drainage ditch north of Urbana, Ill., specimens were also examined from *Rana pipiens* collected by W. W. Cort at Douglas Lake, Mich., and by R. G. Hall from Crystal Lake, Urbana; from *Rana virescens* collected by H. W. Duncanson near Peru, Neb., and from *Bufo lentiginosus,* locality unknown. Much of this material had been identified as *"Taenia dispar"* on the basis of its general form and of its host, but comparison of these specimens with specimens of *Taenia dispar* sent from Neuchâtel, Switzerland, by Dr. Otto Fuhrmann, showed conclusively that the American worms are a distinct species.

Taenia dispar was originally reported by Goeze from toads and frogs in Germany. He described it as being 6 inches long, cylindrical, of greatest diameter at the anterior end and diminishing gradually to a thread-like posterior end. The name "dispar" was suggested by this unusual shape. The color is white except at the posterior end, where it is brownish. Proglottids are distinct only near the posterior end in which region they are filled with numerous brown bodies. All of the proglottids are enclosed in a thin transparent membrane, which is

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clearly visible between the proglottids at the posterior end. Observations were made on living material placed in water and the great activity of the worm noted.

O. Schmidt (1855) studied some eighty or ninety specimens obtained from *Rana temporaria*. He pictures a worm in which the neck is pronounced, being about one half the diameter of the scolex and two fifths the diameter of the body where the testes are at their fullest development. Failing to find the female organs he apparently mistook the testes for ovaries, and while he gives us a description and figure of what is unmistakably an oval cirrus pouch, he fails to recognize it as such, but considers it a part of the female reproductive system. He describes in detail the development of the embryo and subsequent formation of capsules, each surrounding three embryos. Of these capsules he found nineteen to twenty-five in each proglottid, first arranged in the form of a circle, but later becoming scattered irregularly through the proglottid.

Fuhrmann (1895) summarizes the contributions of previous workers and adds a careful and detailed description of his own, a summary of which follows:

Taenia dispar is characterized by its cylindrical form and by the fact that its diameter is greatest at the anterior end and diminishes gradually toward the posterior end. The scolex is unarmed and is not separated from the body by a neck. The pores are lateral and the cirrus and vagina pass dorsal to the longitudinal excretory vessels and main nerve trunk (Textfig. A). The testes are dorsal, two in number, and measure 0.108 by 0.045 mm. The cirrus sac is a strongly muscular organ, having a length of 0.27 mm. and a diameter of 0.026 mm. It terminated in a retractor which extends to the muscle layer on the opposite side of the proglottid.

The female genital organs occupy the ventral part of the proglottid. The ovary is spherical, 0.081 mm. in diameter, surrounded by a delicate membrane and filled with forty to ninety cells 0.014 mm. in diameter. The vitelline gland is also spherical, but its cells are much smaller than those of the ovary. No shell gland was observed. The uterus first appears as a mass of dark cells between the ovary and testes. At its fullest development it is a large horseshoe-shaped organ, the dorsal part of which crowds the remnants of the testes against the dorsal muscles. The uterine wall soon degenerates and the eggs receive their second and then their third membranes from the parenchyma. The parenchyma now becomes concentrated about groups of three or sometimes four eggs, enclosing them in a parenchymatous capsule. These egg capsules, thirteen to thirty in number, become scattered irregularly through the proglottid.

It is noteworthy that there are marked discrepancies between the figures and descriptions of *Taenia dispar*, contributed by Goeze and Fuhrmann on the one hand, and O. Schmidt on the other. While the circular arrangement of the eggs described by Schmidt and the horseshoe-shaped arrangement described by Fuhrmann might readily be accounted for as differences in observation, there are more important differences which cannot be so readily explained. Whereas Goeze

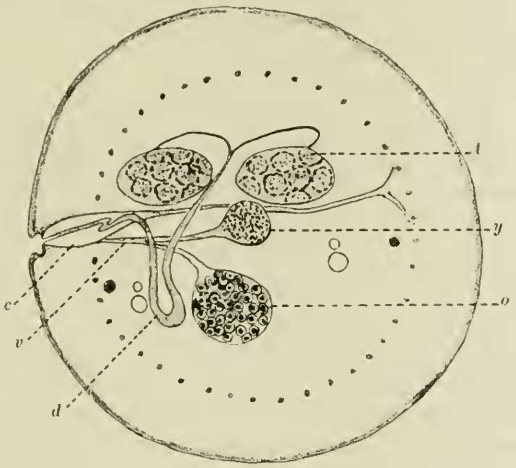

Figure A

Cross section of a mature proglottid of *Taenia dispar*. (After Fuhrmann, 1895); *t*, testes; *c*, cirrus pouch; *d*, vas deferens; *o*, ovary; *u*, uterus; *v*, vagina; *y*, vitellaria.

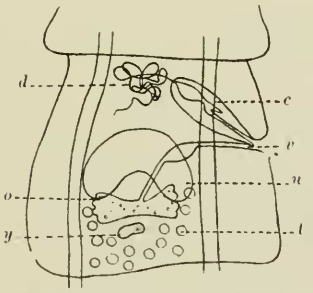

Figure B

Mature proglottid of *Paruterina angustata*, showing the arrangement of organs characteristic of the sub-family Paruterinae. (After Fuhrmann, 1906.)

and Fuhrmann both picture and describe *Taenia dispar* as neckless, having its greatest diameter at the anterior end and diminishing gradually toward the posterior end, Schmidt, as noted above, gives a picture of a worm with a pronounced neck and with its greatest diameter near the posterior end. Further, Fuhrmann describes the cirrus sac as being almost ten times as long as broad, while Schmidt pictures an oval

cirrus sac not more than twice as long as broad. These discrepancies would suggest the possibility that the form worked upon by Schmidt was not *Taenia dispar*, and that the number of taenian species found in amphibians is greater than has heretofore been supposed.

Weinland (1858) attempted to put this form in a new genus, *Proteocephalus*, a position which subsequent workers have shown to be untenable. Lühe (1899) proposed for *Taenia dispar* the generic name *Nematotaenia*, suggested by the cylindrical form and unsegmented appearance of the body. Ransom (1900) gives the following diagnosis for the genus Nematotaenia:

> Paruterinae; scolex unarmed without rostellum. Segmentation of strobila distinct only at the posterior end. Strobila circular in cross section. Genital pores alternate; genital canals pass dorsal to the longitudinal excretory vessels and nerve. Uterus horseshoe shaped, disappears early. Eggs through the action of numerous parauterine organs become inclosed in egg capsules, three or four in each capsule. Adults in amphibia. Type species *Taenia dispar* Goeze 1782.

Stiles and Hassall (1912) record the following as hosts of *Taenia dispar: Bufo americanus, Menobanchus maculatus, Bufo vulgaris, Rana pipiens, Rana temporaria, Ascolobates mauritanicus, Bufo cinereus, Bufo fuscus, Bufo lentiginosus, Hyla arborea, Necturus maculatus, Pleobetes fuscus, Platydactylus guttatus, Rana halecina, Salamandra atra, Salamandra maculata.* It is likely that in some of the above cases, the worm found was not *Taenia dispar*, but the species under consideration in this paper or some form much like it.

Taenia pulchella is known only from the rather meager description given us by Leidy (1851), which runs as follows:

> White, without admixture of any other color, variable, usually broadest anteriorly. Head quadrilateral, subclavate, obtusely rounded, broader than neck. Acetabula circular, cup shaped, lateral and opposite, sessile protractile. Neck very long, cylindroid. Articuli containing several colorless globules; anteriorly subglobular or transversely oval; posteriorly moniliform, longitudinally oval, or cylindroid and centrally incrassate. Entire length, 50.8 to 238.6 mm. Scolex, diameter, 0.34 mm. Acetabula, 0.127 to 0.153 mm. Anterior proglottids, length, 0.34 mm.; diameter 0.254 to 0.53 mm. Ripe proglottids, length, 0.53 to 0.57 mm.; diameter, 0.19 to 0.34 mm. Host, *Bufo americanus*.
>
> Closely resembles *Taenia dispar* Goeze, found in *Bufo viridus*, etc., but it is relatively longer and narrower and is never colored.

Morphology of the New Species.—In making and tabulating measurements, the worms from *Acris gryllis* were found to fluctuate about a different mode from those from *Rana pipiens*, being usually smaller; however, since every gradation in size has been found and the larger worms from *Acris gryllis* are larger than the smaller ones from *Rana pipiens*, and since also it has been observed in *Acris gryllis* that in cases of heavy infection mature worms are much smaller than those found in lightly infected hosts, sometimes not more than one half the diameter, the author feels no hesitation in saying that only one species is concerned.

Adult worms bearing ripe proglottids, from *Acris gryllis*, vary in length from 25 to 40 mm. when in a state of moderate extension. Young worms 1.5 mm. in length were repeatedly found in the intestine. The worms from *Rana pipiens* were not observed alive, but from preserved materials their length may be estimated to have reached a maximum of 80 mm.

The most characteristic feature of the worm, noted upon a superficial examination, is its cylindrical form. The color is glistening white throughout the entire length. The scolex is spherical, 160 to 200μ in diameter in the region of the suckers, which have a diameter of from two fifths to one half that of the scolex. Thus in one scolex having a diameter of 180, the suckers are 97μ. The neck is long and has a diameter of 130 to 150μ. In a typical specimen from *Acris gryllis* 37 to 40 mm. in length, the neck has a diameter of 134μ. The first appearance of the reproductive system is as a dark streak down the center of the worm about 5 mm. behind the head. Here the diameter is still 134μ.

Soon the line of undifferentiated cells becomes broken into triangles, having their bases directed laterad and their species alternating with each other in the median line. Six mm. behind the head the differentiation of the testes becomes apparent. In this region the proglottids have a length of 9μ and a diameter of 162μ. Eleven mm. behind the head the proglottids are mature and the first eggs are passing into the uterus. Here the proglottids measure 20 by 157μ. The greatest diameter of the worm is found where the uterus has reached its fullest development and the para-uterine organ is forming, about 22 mm. behind the head. In this region the proglottids are 40 to 45μ long and 180 to 200μ in diameter. When the worm is contracted the diameter may be 350μ.

Soon after, about 24 mm. from the head, the proglottids begin to elongate rapidly and indications of external segmentation appear. They now have a length of 54 and a diameter of 135μ. From 27 to 36 mm. behind the head the segmentation is very distinct. The proglottids measure 82 by 108μ and break off easily. The last few proglottids of a strobila and the detached proglottids frequently have a length much exceeding their diameter, 146 by 72μ to 178 by 74μ. In specimens from *Rana pipiens* the proglottids attain a maximum diameter of 270μ and ripe proglottids a length of 340μ and diameter of 250μ. Detached ripe proglottids have been found singly and in groups of from two to five in the cloaca of the host.

In living material the parenchymatous para-uterine organs which contain the oncospheres appear as two transparent spherical bodies in the center of each proglottid.

The cuticula is from 3 to 4μ thick, and composed of three layers, the central one of which is thinnest. Beneath the cuticula is the usual

basement membrane and parenchyma. The subcutaneous muscles are weakly developed, the longitudinal muscles are pronounced, dorsoventral muscles appear to be entirely wanting.

The ventral excretory canals vary in diameter from 3.5 to 12μ, usually from 5 to 7μ in parts anterior to the appearance of external segmentation. The dorsal canals vary in diameter between 1 and 4.5μ. They are but little smaller than the ventral canals in the region of the scolex, but are insignificant throughout the remainder of their length. The usual median excretory bladder is clearly visible at the posterior end of young specimens.

All of the organs of the reproductive system, with the exception of parts of the cirrus and vagina, are confined to the medullary region of the proglottid. The genital pores are lateral and alternate somewhat irregularly, though with a marked tendency toward regularity. Thus in one instance twenty-four pores alternate regularly, then two are on the right margin and the next two on the left; then four alternate regularly, two are at the right, five alternate regularly and two more are at the right, twelve alternate regularly and two are at the left, etc. More than two pores have never been observed to occur successively on the same side.

The cirrus and vagina pass dorsal to the main excretory canals and nerve trunk. The male organs occupy the dorsal part and the female organs the ventral part of the proglottid (Fig. 7). The single testis is situated dorsally on the aporal side of the proglottid. It varies from 26 to 34μ in diameter, being usually about 29μ at its greatest development, and is spherical except when anteroposteriorly compressed by the contraction of the worm. From it the vas deferens leads with but few undulations directly to the cirrus. This latter organ is surrounded by a thick club-shaped cirrus pouch 36 to 44μ long and 13 to 17μ in diameter. The cirrus pouch, vas deferens, and female organs are enclosed in a delicate sheath.

The vagina opens from the genital cloaca posterior to the male orifice and follows the cirrus inward. Near the end of the cirrus sac the vagina begins to curve ventrad. It meets the duct from the vitelline gland and the very short oviduct about the level of the principal nerve trunks. The single spherical ovary lies in the ventral half of the medullary region. It has a diameter of from 24 to 34μ, and contains from eight to sixteen large, spherical, loosely arranged cells 9μ in diameter, surrounded by a membranous capsule. The vitelline gland lies dorsilateral to the ovary and in the median line. It is spherical, 18μ in diameter, and composed of large deeply staining cells. The vitelline duct passes laterad, meeting the oviduct in an enlargement at the point of formation of the uterine duct. No special muscular oötype has been observed. A mass of deeply staining cells dorsal to

the vitelline duct is the anlage of the uterus. After fertilization the distal end of the oviduct becomes dilated and filled with sperm and yolk cells through which the egg must pass before entering the uterus.

The ova, when mature, pass in rapid succession through the oötype and into the uterus so that the ovary and vitelline glands soon disappear entirely. The uterus, an oval sac, lies on the porel side of the proglottid with its long axis directed dorsiventrally. At its fullest development it attains a size of 40 by 24μ. The eggs at the time they enter the uterus may be surrounded by a transparent membrane, though groups of ova and yolk cells around which no membrane has yet formed are frequently found in the uterus. The complete eggs have a mean diameter of 12 to 14μ.

The parenchyma on the aporal side of the uterus now becomes arranged as a meshwork of heavy deeply staining strands running parallel to the long axis of the uterus. This is the beginning of the parenchymous structure which, following Fuhrmann, I shall term the *para-uterine organ* (Fig. 2).

The growth of the para-uterine organ is rapid, and it soon appears as two truncated cones, one dorsal and one ventral, their bases lying against the uterus, which has become much flattened, and their apices extending almost to the circular muscles on the opposite side (Fig. 3). The basal portion of the cones is composed of a meshwork of fine dorsiventrally directed fibers. The apical parts are surrounded by heavy deeply staining fibers, among which lie numerous dark nuclei.

Meanwhile the eggs have initiated cleavage and have developed their second membrane, a thick deeply staining capsule, while the uterus, which was pushed close against the eggs by the growth of the para-uterine organ, has broken down into a number of tertiary capsules surrounding the individual embryos.

With the rapid elongation of the proglottid (Figs. 4 and 5) the position of the cones is shifted so that their longitudinal axes correspond very nearly to the longitudinal axis of the worm. Their apices lie in the anterior end of the proglottid and their basal portions, in which are the embryos enclosed in their uterine capsules, occupy the posterior part of the proglottid. At the same time the apical portions of the cones acquire well-defined walls and become somewhat constricted from the basal portions, while the spongy fibers which have filled them disappear leaving them hollow. By the time the proglottids have become distinctly set off, the apical portions of the cones appear as two thick-walled hollow spheres 20μ in diameter, lying one dorsal, the other ventral, in the anterior end of the proglottid, while the meshwork of lamellated fibers has largely disappeared from the interior of the basal portions of the cones. At this time the embryos have a diameter of 20μ and have developed the six hooks characteristic of the tapeworm oncosphere.

The oncospheres now begin to migrate foreward into the spherical capsules of the para-uterine organ, which grow rapidly to a diameter of 124 to 130μ (Fig. 6). At the time of the separation of the proglottids those embryos which have not yet migrated into the para-uterine capsule are usually set free by the tearing open of the end of the proglottid, so that a detached proglottid, when found in the cloaca of the host, frequently contains not more than five to seven oncospheres (Fig. 9).

The development of the para-uterine organ just described bears many resemblances to that described for *Metroliasthes lucida* by Ransom (1900). The chief differences are in the relative size and duration of the uterus and the number of para-uterine organs formed. In the form under discussion, as noted above, the uterus is relatively small and breaks down into membranes surrounding the embryos long before the development of the oncospheres is complete or the para-uterine capsule is ready to receive them. In *Metroliasthes lucida,* quoting Ransom, "at the height of its development the uterus occupies almost the whole of the inner parenchyma back to the genital pore and bulges out the proglottid wall dorsally and ventrally," and the uterus does not degenerate until the six-hooked embryos have taken up their final position in the para-uterine capsule. As to the number of para-uterine capsules formed, while in the form under discussion there are two, *Metroliasthes lucida,* although possessing a two-lobed ovary, has but one.

Fuhrmann (1906) has given in less detail the development of the para-uterine organ in *Paruterina angustata* and *Culcitella rapaciola,* (1908a) of *Anonchotaenia globata* and (1909) of *Biuterina clavulus.* Cholodkovsky (1906) has given a brief account of the formation of the para-uterine organ in *Rhabdometra tomica.* All of these forms resemble *Metroliasthes lucida* in that the uterus persists until the oncospheres have passed into the single para-uterine organ. *Taenia dispar,* on the other hand, resembles this form in that the uterus breaks down early, but far exceeds it in the number of para-uterine organs, of which there are from thirteen to thirty.

While the form under discussion bears some likeness to *Taenia pulchella* Leidy 1851, such as its occurrence in an anuran, its long neck, white color and cylindrical form, this similarity is far too generalized to establish identity. Since I have been unable to secure for comparison any of Leidy's material, which is reported to be no longer in existence, I must leave open the question of the possible identity of the two forms and treat this as a new species.

Fuhrmann (1908b) has revised the classification of the Cyclophyllides. Of his seven families it is the *Dilepinidae* with whose characters this worm agrees. The family is defined as follows: "Rostellum

usually armed, suckers unarmed, genital pores marginal, genital organs single or double in each proglottid." This family contains twenty-eight genera, which Fuhrmann has separated into three subfamilies on the basis of the character of the uterus.

The subfamily *Dilepinae* contains the genera in which the uterus is sac-shaped or has simple lobes. In most the uterus persists. The subfamily *Dipylidiinae* includes the genera in which the uterus breaks up into parenchymatous capsules which contain one or more oncospheres. The subfamily *Paruterinae* includes those genera in which a parenchymatous para-uterine organ is formed into which the embryos later penetrate. The enclosure of the embryos in the para-uterine capsule places the worm under consideration in this paper in the subfamily Paruterinae.

A comparison of the description of this form, given above, with the description of *Taenia dispar* given by Fuhrmann, reveals striking resemblances between the two (Fig. 7 and Textfig. A). Alike they are characterized by their cylindrical form and late differentiation of proglottids. The ovary and vitellaria are spherical and ventral, the vitellaria, however, being dorsal to the ovary. The testes are large, dorsal and of a definite and limited number, one in this form, two in *Taenia dispar*. The cirrus and vagina are dorsal to the longitudinal excretory canals, and the number of eggs produced in each proglottid is small; eight to twelve in the former, not more than ninety in the latter. They are further alike in that the uterus breaks down early before the para-uterine capsules have been formed, and in having more than one para-uterine organ.

Of the other six genera of the Paruterinae, five: namely, *Paruterina, Biuterina, Culcitella, Rhabdometra* and *Metroliasthes,* are alike flattened dorsiventrally, the proglottids are distinct at the time of maturity or earlier, the female reproductive organs are anterior to the testes and the vitellaria posterior to the ovary. The testes are small, numerous (twenty to forty), and of an inconstant number, and occupy the posterior part of the proglottid (Textfig. B). The cirrus and vagina pass between the excretory canals. (In *Paruterina angustata,* Fuhrmann, the dorsal canal has not been observed. The genital ducts, however, pass dorsal to the ventral canal.) That the eggs are very numerous is suggested by the pictures, though no one has ever counted them. The uterus is relatively large and persists until the embryos pass into the single para-uterine organ.

Thus it is seen that the genera of Fuhrmann's subfamily Paruterinae fall into two distinct groups in one of which is *Nematotaenia;* in the other the five genera named above. The genus *Anonchotaenia* differs somewhat from either group. While the testes are small and numerous, they are dorsally situated, and the ovary, vitellaria and uterus are arranged laterally from the genital pore in the order named. How-

ever, this difference in the position of organs seems to be brought about by the shortness of the proglottid which would not admit the anteroposterior arrangement common in the other forms. Since, therefore, *Anonchotaenia* is similar in general characters and in the aspect of the mature proglottid, and since the development of the para-uterine organ and of the uterus, which persists until the embryos have passed into the para-uterine organ, resembles that of *Paruterina* and *Biuterina* much more closely than that of any other form, I consider that *Anonchotaenia* is rightly placed in the subfamily with *Paruterina, Biuterina, Culcitella, Rhabdometra* and *Metroliasthes.*

For *Nematotaenia* and the species under consideration in this paper, because of the pronounced differences in the aspects of the mature proglottids, the early degeneration of the uteri and the late formation of the para-uterine capsules, of which there are more than one in each proglottid, it seems necessary to establish a new subfamily, *Cylindrotaenianae:* Cylindrical Dilepinidae having one or two dorsally placed testes, ovary and vitellaria ventral, vitellaria dorsal to ovary. Proglottids distinct at the posterior end only. The uterus breaks down early and the embryos are later enclosed in para-uterine capsules. *Taenia pulchella* Leidy would probably also belong to this subfamily.

On the other hand, notwithstanding their marked similarity in the respects noted above, *Taenia dispar* and this new worm show certain important differences. As to external characters it may be mentioned that whereas the former has its greatest diameter at the anterior end and diminishes gradually to the posterior end, the latter has its greatest diameter about midway of the strobila and narrows toward both ends.

Of greater importance is the difference in the male reproductive system. Whereas *Taenia dispar* has two symmetrically placed oval testes and the vas deferens forms a loop which passes ventrad as far as the excretory canals, this new worm has a single spherical testis situated lateral to the median line of the proglottid and a simple straight vas deferens. And whereas the cirrus sac of *Taenia dispar* is almost ten times as long as wide, that of the worm herein discussed is only two and one-half times as long as wide.

Nowhere are the differences more striking than in the development of the para-uterine organs (Figs. 5 and 12) and the aspect of the ripe proglottids (Figs. 9 and 11) for in place of the two large elaborate cone-shaped structures noted above, which are probably the most noticeable and characteristic structures of the worm, *Taenia dispar* has a varying number of small para-uterine organs in no wise characteristic; and in place of the two large, transparent, spherical para-uterine capsules found in the ripe proglottids of this form, the ripe proglottids of *Taenia dispar* have from thirteen to thirty small dark capsules scattered through the parenchyma.

From these considerations it becomes evident that this form does not belong to the genus *Nematotaenia,* which it most closely resembles of any of the genera yet established, and it is necessary to establish a new genus for its reception.

This generic description would be as follows:

Genus *Cylindrotaenia.* Scolex unarmed, without rostellum; reproductive organs single in each proglottid; pores lateral, alternating; vagina and cirrus dorsal to the excretory canals and main nerve trunk; testis one, dorsal; ovary and vitellaria ventral. Uterus breaks up into capsules surrounding the embryos which ultimately pass into two parauterine capsules.

Type species *Cylindrotaenia americana.* Characters given above. From small intestine of various Anura. Type specimens in the collections of Henry B. Ward and M. E. Jewell.

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EXPLANATION OF PLATE

a Apical portion of Para-uterine organ
b Basal portion of Para-uterine organ
c Cirrus pouch
e Eggs
ec Excretory canals
em Embryo
m Longitudinal muscles
n Nerve
o Ovary
p Para-uterine organ
r Receptaculum seminis uterinum
s Septum between proglottids
t Testis
u Uterus
v Vagina
vd Vas deferens
vt Vitellaria

All figures from camera lucida tracings except 7 and 8 which are reconstructions.

Figures 1-10 *Cylindrotaenia americana.*

Fig. 1.—Scolex, × 37.

Fig. 2.—Cross section of a proglottid with fully developed uterus and para-uterine organ forming, × 165.

Fig. 3.—Cross section of a proglottid in the region of greatest diameter, × 160.

Fig. 4.—Cross section of a proglottid at the beginning of external segmentation, × 160.

Fig. 5.—Toto mount, lateral view of a somewhat later stage, × 175.

Fig. 6.—Toto mount, lateral view of a proglottid near the end of the strobila, × 235.

Fig. 7.—Cross section of a mature proglottid, × 165.

Fig. 8.—Cross section of a somewhat later stage showing the formation of the uterus, × 165.

Fig. 9.—Detached ripe proglottid, × 235.

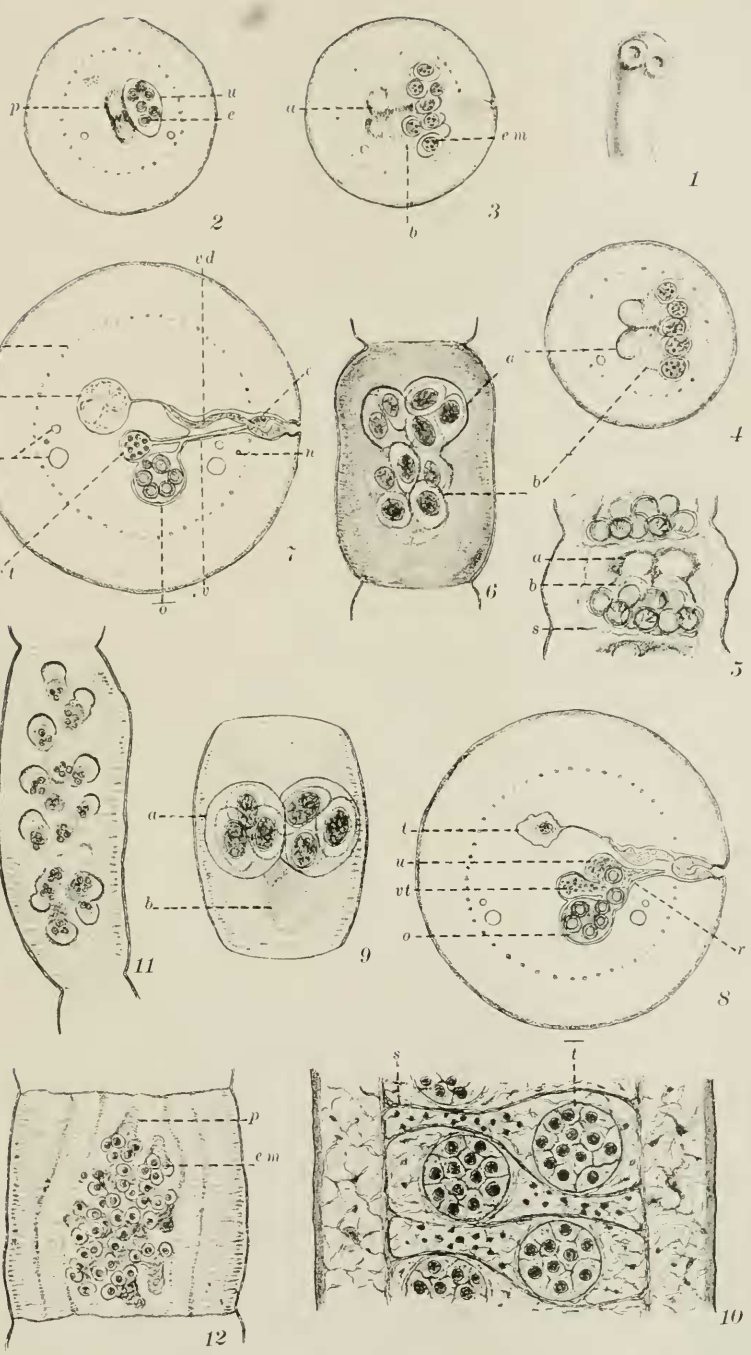
Fig. 10.—Frontal section of three proglottids in the region of the greatest development of the testes, × 325.

Figs. 11 and 12.—*Taenia dispar;* from materials sent from Neuchatel, Switzerland.

Fig. 11.—Toto mount, ripe proglottid. Stage corresponding to Figure 9 in *Cylindrotaenia americana,* × 50.

Fig. 12.—Toto mount, proglottid from near the end of the strobila showing para-uterine organs. Stage corresponds to Figure 5, × 70.

PLATE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